AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Withdrawn) A reverse spreading device for reversely spreading complex base band signal, one being composed of an I (In-phase signal) component and another being composed of a Q (Quadrature phase signal) component and each being spread using spread codes of n-pieces of chips for one symbol signal comprising:

a first correlator having first delay devices whose number is an integral multiple of n-l and which sequentially shift said base band signal composed of said I component by delaying it at a predetermined time interval, having n-pieces of first multipliers each performing a multiplication between said base band signal composed of said I component shifted by said first delay devices and a spread code and having m-pieces of first adders each performing integration of an output from k-pieces of said first multipliers out of n-pieces of said first multipliers and outputting the result of said integration as an intermediate signal composed of said I component (m=n/k);

a second correlator having second delay devices whose number is the same as that of chips for one symbol signal sequentially shifted by delaying said base band signal composed of said Q component at a predetermined time interval, having n-pieces of second multipliers each performing a multiplication between said base band signal composed of said I component sequentially shifted by said second delay devices and said spread code and having m-pieces of second adders each performing integration of an output from k-pieces of said first multipliers out of n-pieces of said first multipliers and outputting the result of said integration as an intermediate signal composed of said Q component;

m-pieces of phase rotators each performing a rotation correction by phase-rotating m-pieces of said intermediate signals each being composed of said I component produced by each of said first correlators and m-pairs of complex intermediate signals containing m-pieces of intermediate signals composed of said Q component produced by said each of said second correlators, on a complex plane at a phase rotation angle at m-stages each being slid by a reference rotation angle for every pair of said complex intermediate signals;

a first adder to perform calculation of a correlation value composed of said I component by doing integration of said I component of said m-pieces of said complex

intermediate signals obtained after said rotation correction is made by each of said phase rotators; and

a second adder to perform calculation of a correlation value composed of said Q component by doing integration of said Q component of said m-pieces of said complex intermediate signals obtained after said rotation correction of each of said phase rotators is made.

2. (Withdrawn) A reverse spreading device for reversely spreading complex base band signals, one being composed of an I (In-phase signal) component and another being composed of a Q (Quadrature phase signal) component and each being spread using spread codes of n-pieces of chips for one symbol signal comprising:

a first multiplier to sequentially perform a multiplication between base band signals composed of said I component and said spread codes of n-pieces of chips;

a first correlator to produce m-pieces of intermediate signals composed of said I component by sequentially integrating said multiplied value obtained by said first multiplier for every k-pieces and by using said multiplied value as said intermediate signal and to output them as (m=n/k);

a second multiplier to sequentially perform a multiplication between said base band signals composed of said Q component and said spread codes of n-pieces of chips;

a second correlator to produce m-pieces of intermediate signals composed of said Q component by sequentially integrating said multiplied value obtained by said first multiplier for every k-pieces multiplied values and by using said multiplied value as said intermediate signals and to output them;

a phase rotator to perform a rotation correction by phase-rotating m-pieces of complex intermediate signals containing said intermediate signal composed of said I component and said intermediate signal each composed of said Q component on a complex plane at a phase rotation angle at m-stages each being slid by a reference rotation angle for every pair of said complex intermediate signals;

a first adder to perform calculation of a correlation value composed of said I component by doing integration of said I component of said m-pieces of said complex intermediate signal obtained after said rotation correction by each of said phase rotators is made; and

a second adder to perform calculation of a correlation value composed of said Q component by doing integration of said Q component of said m-pieces of said complex intermediate signals obtained after said rotation correction by each of said phase rotators is made.

3. (Currently Amended) A reverse spreading device for reversely spreading complex base band signals, comprising one base band signal being composed of an I (In-phase signal) component and another base band signal being composed of a Q (Quadrature phase signal) component and each base band signal being spread using spread codes of n-pieces of chips for one symbol signal comprising:

a frequency error correcting device to count how many chips of said complex base band signals to be inputted and to perform a rotation correction in a step-by-step manner by rotating a phase of said complex base band signals on a complex plane at a phase rotation angle at m-stages each being slid by a reference rotation angle being an angle obtained by dividing a rotation angle (2π) of a revolution to M portions every time a count of the chips increases by ~~K-chip~~ K-chips;

a spread code multiplier to multiply each of the complex base band signals obtained after the rotation correction by said frequency error correcting device is made, by said spread codes; and

two accumulative adders to produce a correlation value composed of said I component and a correlation value composed of said Q component by performing accumulative addition of the multiplied value from said spread code multiplier for one symbol period for each of said I component or Q component.

4. (Original) The reverse spreading device according to Claim 3, wherein said frequency error correcting device is composed of a chip number counter to sequentially count how many chips of said complex base band signal to be inputted and to provide an instruction for incrementing every time when count of chips increases by K-chips, of a step number counter to increase said step number by one if the outputted step number is a number other than M-1 and to return said step number to 0 if said step number is M-1 in accordance with said instruction for incrementing fed from said chip number counter and of a phase rotator to perform a rotation correction by rotating a phase of said complex base band signals at a phase

rotation angle corresponding to a step number fed from said step number counter, out of phase rotation angles at M stages slid by said reference rotation angle.

5. (Withdrawn) The timing detecting device comprising said reverse spreading device claimed in Claim 1 and a peak detecting circuit to detect spreading timing based on sizes of correlation values of said I component and said Q component obtained by said reverse spreading in said reverse spreading device.

6. (Withdrawn) The channel estimating device comprising said reverse spreading device claimed in Claim 1 and a rotation correcting circuit to detect a phase error contained in a complex symbol obtained by said reverse spreading device and to perform correction of said phase error.

7. (Withdrawn) The timing detecting device comprising said reverse spreading device claimed in Claim 2 and a peak detecting circuit to detect spreading timing based on sizes of correlation values of said I component and said Q component obtained by said reverse spreading in said reverse spreading device.

8. (Withdrawn) The channel estimating device comprising said reverse spreading device claimed in Claim 2 and a rotation correcting circuit to detect a phase error contained in a complex symbol obtained by said reverse spreading device and to perform correction of said phase error.

9. (Currently Amended) ~~The~~ A timing detecting device comprising said reverse spreading device as claimed in Claim 3 and a peak detecting circuit to detect spreading timing based on sizes of correlation values of said I component and said Q component obtained by said reverse spreading in said reverse spreading device.

10. (Currently Amended) ~~The~~ A channel estimating device comprising said reverse spreading device claimed in Claim 3 and a rotation correcting circuit to detect a phase error contained in a complex symbol obtained by said reverse spreading device and to perform correction of said phase error.

11. (Withdrawn) A method for measuring a frequency error being a difference between a reference frequency of a receiver and a reference frequency of a sender comprising steps of:

shifting sequentially a base band signal composed of an I (In-phase signal) component and a base band signal composed of a Q (Quadrature phase signal) component and performing a multiplication between said shifted said base band signals each being composed of said I component or said Q component;

performing integration of k-pieces of multiplied values out of n-pieces of multiplied values obtained and producing m-pieces of intermediate signals composed of an I component (m=n/k);

performing a rotation correction by rotating phases of m-pairs of complex intermediate signals including m-pieces of intermediate signals composed of said I component and m-pieces of intermediate signals composed of said Q component at a phase rotation angle at m-stages each being slid by a reference rotation angle for every one pair of complex intermediate signals;

calculating a correlation value of said I component and a correlation value of said Q component by integrating said I component and said Q component of said m-pieces of said complex intermediate signals obtained after said rotation correction is made; and

calculating a power value of a complex symbol based on said correlation values of said I component and said Q component and selecting said reference rotation angle so that said power value becomes maximum and then detecting said frequency error based on said reference rotation angle selected.

12. (Withdrawn) A method for measuring a frequency error being a difference between a reference frequency of a receiver and a reference frequency of a sender comprising steps of:

performing a multiplication between base band signals, one being composed of an I component of n-pieces of chips and another being composed of a Q component of n-pieces of chips and spread code of n-pieces of chips and producing m-pieces of intermediate signals, one being composed of said I component and said Q component by integrating a multiplied value for every k-pieces of said multiplied value and to use an integrated value as an intermediate signal (m=n/k) ;

performing a rotation correction by rotating phases of m-pairs of complex intermediate signals including m-pieces of intermediate signals composed of said I component and m-pieces of intermediate signals composed of said Q component at a phase

rotation angle at m-stages each being slid by a reference rotation angle for every one pair of complex intermediate signals;

calculating a correlation value of said I component and a correlation value of said Q component by integrating said I component and said Q component of said m-pieces of said complex intermediate signals obtained after said rotation correction is made; and

calculating a power value of a complex symbol based on said correlation values of said I component and said Q component and selecting said reference rotation angle so that said power value becomes maximum and then detecting said frequency error based on said reference rotation angle selected.

13. (Currently Amended) A method for measuring a frequency error being a difference between a reference frequency of a receiver and a reference frequency of a sender comprising steps of:

counting how many chips of complex base band signals are to be inputted;

performing a rotation correction in a step-by-step manner by rotating a phase of said complex base ~~band~~ signal on a complex plane at a phase rotation angle at m-stages each being slid by a reference rotation angle being an angle obtained by dividing a rotation angle (2π) of a revolution to M portions every time said counted number of the chips increases by ~~K-chip~~ K-chips;

multiplying the complex base band signals by spread signals obtained after the rotation correction is made by said frequency error correcting device;

producing a correlation value of the I component and a correlation value of the Q component by adding the multiplied value fed from said spread code multiplier in an accumulative manner for every I component and every Q component during one symbol period:

calculating a power value of the complex symbol based on the correlation values of said I component and said Q component and selecting said reference rotation angle so that the power value becomes maximum and then detecting said frequency error based on said reference rotation angle selected.

14. (Withdrawn) An AFC (Automatic Frequency Control) method to control a frequency of a reference frequency signal of a mobile station so that a frequency error measured by said frequency error measuring method claimed in claim 11.

15. (Withdrawn) An AFC (Automatic Frequency Control) method to control a frequency of a reference frequency signal of a mobile station so that a frequency error measured by said frequency error measuring method claimed in claim 12.

16. (Currently Amended) A method in accordance with claim 13 ~~An~~ for AFC (Automatic Frequency Control) of a mobile station, ~~method~~ further comprising the step of:

~~to control a~~ controlling the frequency of a reference frequency signal of ~~a~~ the mobile station so that ~~a~~ the frequency error detected in the calculating step is reduced ~~measured by said frequency error measuring method claimed in claim 13~~.